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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/647,074	08/22/2003	Christopher Vineis	ASC-58A	9702
21323	7590	03/01/2005	EXAMINER	
TESTA, HURWITZ & THIBEAULT, LLP HIGH STREET TOWER 125 HIGH STREET BOSTON, MA 02110			LEE, HSIEN MING	
			ART UNIT	PAPER NUMBER
			2823	

DATE MAILED: 03/01/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/647,074

Applicant(s)

VINEIS ET AL.

Examiner

Hsien-ming Lee

Art Unit

2823

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 09 December 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 19-21 is/are allowed.
- 6) ☒ Claim(s) 1,5,6,9-12 and 15-18 is/are rejected.
- 7) ☒ Claim(s) 2-4,7,8,13 and 14 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The <sup>replaced</sup> drawing(s) filed on 09 December 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

HSIEN-MING LEE  
PRIMARY EXAMINER

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Remarks*

1. The objection against claims 5, 6, 10, 11, 15, 16, 18, 20 and 21 is withdrawn.
2. The indication of allowable subject matter is withdrawn in response to a newly discovered prior art.

### *Claim Rejections - 35 USC § 102*

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1, 5, 6, 9-12 and 15-18 are rejected under 35 U.S.C. 102(e) as being anticipated by Cheng et al. (US 2002/0168864).

In re claims 1 and 12, Cheng et al. teach a method for forming a relaxed graded semiconductor layer (i.e. a graded Ge-Si layer) on a substrate, the method comprising the steps of:

- providing a first semiconductor layer 2 (i.e. a silicon substrate);
- epitaxially growing over the first semiconductor layer 2 a relaxed graded layer 6 comprising at least silicon and germanium, with increasing germanium content at a gradient exceeding about 25% Ge/ $\mu\text{m}$  (Fig. 1(a) and paragraph [0024]) to a final composition having a germanium content ranging from greater than 0% to 100% (i.e. ranging from 0% to about 25%, which allows

covering slightly exceed 25%) and a threading dislocation density not exceeding about  $10^7/\text{cm}$ , i.e. of about  $\sim 10^5/\text{cm}$  (paragraph [0024]).

In Fig.2, Cheng et al. further clearly demonstrate that the a relaxed graded layer 30 comprising at least silicon and germanium, with increasing germanium content at a gradient exceeding about 25% Ge/ $\mu\text{m}$ , i.e. up to 30 Ge/ $\mu\text{m}$ ,

In re claims 5, 15, Cheng et al. teach that the gradient is at least 30% Ge/ $\mu\text{m}$  (line 8 in paragraph [0023]).

In re claims 6, 16, Cheng et al. teach that the gradient is at least 40% Ge/ $\mu\text{m}$ , i.e. up to 80% Ge/ $\mu\text{m}$  (paragraph [0040]).

In re claims 9, 17, Cheng et al. teach that the relaxed graded layer 6 has a thickness about 0.25  $\mu\text{m}$  because the Ge gradient in the relaxed graded layer 6 is at least 25% Ge/ $\mu\text{m}$ , i.e.  $1\ \mu\text{m} \times 25\% = 0.25\ \mu\text{m}$ .

In re claim 10, Cheng et al., in Fig.6, further teach providing a first semiconductor layer 54/56; epitaxially growing over the first semiconductor layer 54/56 a relaxed graded layer 62 comprising at least silicon and germanium, with increasing germanium content at a gradient exceeding about 25% Ge/ $\mu\text{m}$  to a final composition having a final composition having a germanium content ranging from 20% to 80%; and the first semiconductor layer 54/56 has a plurality of threading dislocations distributed substantially uniformly across a surface thereof, and providing a compositionally uniform cap layer 60 (i.e. relaxed SiGe etch-stop layer) over the surface of the first semiconductor layer 54/56, the cap layer 60 being substantially relaxed, the relaxed graded layer 62 being grown over the cap layer 60.

In re claim 11, Cheng et al. inherently teach that a lattice constant of the compositionally uniform cap layer 60 is different from a lattice constant of the first semiconductor layer 54/56 because of the compositional differences.

In re claim 18, Cheng et al. also teach the claimed limitations, as stated in the rejections against claims 10-11.

*Allowable Subject Matter*

5. Claims 19, 20 and 21 are allowed.
6. Claims 2-4, 7-8, 13, 14, are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.
7. The following is a statement of reasons for the indication of allowable subject matter:

The prior art of record at least neither teaches nor suggests that the graded layer has a dislocation pile-up density not exceeding about 20/cm (claim 2), not exceeding about 1/cm (claims 3, 13), not exceeding about 0.01/cm (claims 4, 14); the epitaxial growth occurs at a temperature ranging from 900~1200 °C (claim 7); a p-type metal-oxide-semiconductor transistor disposed over the relaxed cap layer (claims 19, 21); and a n-type metal-oxide-semiconductor transistor disposed over the relaxed cap layer (claims 20, 21).

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hsien-ming Lee whose telephone number is 571-272-1863. The examiner can normally be reached on Tuesday-Thursday (8:00 ~ 6:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 571-272-1855. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Hsien-ming Lee  
Primary Examiner  
Art Unit 2823

Feb. 23, 2005

HSIEN-MING LEE  
PRIMARY EXAMINER

2/23/2005